

REMARKS/ARGUMENTS

In a Final Office Action mailed on 11 March 2003, the Examiner rejected pending claims 1-6 as being unpatentable under 35 U.S.C. 103(a) over U.S. Patent No. 6,389,494 (issued May 14, 2002, "Walton"). The Examiner also rejected claim 7 under 35 U.S.C. 103(a) as being
5 unpatentable over Walton in view of *Computer Architecture: A Quantitative Approach*, by Hennessy and Patterson ("Hennessy"). The Examiner also rejected claim 12 under 35 U.S.C. 103(a) as being unpatentable over Walton in view of U.S. Patent No. 5,394,532 (issued Feb. 28, 1995, "Belsan"). The Examiner also rejected claim 13 under 35 U.S.C. 103(a) as being
10 unpatentable over Walton in view of Hennessy. The Examiner also rejected claims 8-10 and 14-23 as being unpatentable under 35 U.S.C. 103(a) over Walton in view of U.S. Patent No. 6,148,414 (issued Nov. 14, 2000, "Brown").

Applicant respectfully traverses the rejections and requests reconsideration and withdrawal of the rejections. In the interests of advancing prosecution, Applicant has amended claims 1-3, 5, 6, 14, and 19 for editorial clarity and to better protect the invention. Claim 11 was
15 cancelled in a prior Non Final Office Action Response.

SECTION 103 REJECTIONSClaims 1-10, 12, and 13

As stated in Applicant's specification, "front-end" refers principally to the host system
20 interfacing functions. Exemplary of the functions performed by such front-end controllers are higher-level I/O request processing, such as RAID storage management for redundancy, RAID logical to physical storage mapping, hierarchical storage management, network file protocol support, high-level data striping, backup and restore, routing of I/O requests among controllers, and management functions to map storage to data applications. Also stated in Applicant's
25 specification, "back-end" refers to lower level control functions relating to disk drive interfacing and associated physical I/O operations on the disk drives. Exemplary of such back-end control functions are high availability storage functions (i.e., RAID management), high performance disk interfacing, high bandwidth I/O management, local device management and data management primitives such as data snapshots and data migration. These front-end and back-
30 end control elements can be added independently of one another such that the front-end control elements differ in number from the back-end control elements.

As regards rejected claim 1, the Examiner states Walton does not mention front-end control elements, back-end control elements and interconnect elements that may be added independently of all other such elements. The Examiner further states that it would have been obvious at the time the invention was made to a person having ordinary skill in the art to specify

5 that the control elements and the interconnect elements may be added independent of all other such elements because it would provide for the addition of more elements or for the removal and isolation of a failed element without causing hindrance or disruption to the operation of the overall system. Applicant respectfully disagrees and believes the Examiner's remarks are based on hindsight because, inter alia, Walton does not teach or reasonably suggest such independence.

10 Nowhere does Walton teach or reasonably suggest a storage system adapted to implement additional front-end control elements, back-end control elements, and interconnect elements independent of all other such elements. Nor does Walton teach or reasonably suggest that the front-end control elements differ in number from the back-end control elements. Walton states "at least one front-end one of the directors is in communication with the host computer and at

15 least one rear- end one of the directors is in communication with the bank of disk drives." This statement merely implies that front-end directors are in communication with the host computer and that back-end directors are in communication with the disk drives. Walton's drawings show front-end directors matched with rear-end directors when connected to state bus section 124 (see figure 2 and associated descriptive text). The Examiner's understanding of this passage does not

20 follow from a simple parsing of the words. Rather, it relies on the teachings of Applicant's invention.

Walton does not reasonably suggest independent directors (e.g., front-end directors differing in number from rear-end directors), since each of Walton's front-end directors (e.g., 126_{1,0} of figure 2) are shown as *matched* with rear-end directors (e.g., 126_{5,0} of figure 2) through

25 the state data bus section (e.g., Bus D of 124 of figure 2). No other directors are coupled to Bus D. Other pairs of front and rear directors are coupled to corresponding matched state interface buses (A, B and C). This is a key to Walton's invention so that Walton segregates state data transfers from user data transfers to the shared memory structures. That connection certainly does not reasonably suggest independence of such directors. To the contrary, such a connection

30 reasonably suggests dependence of each front-end director upon a specific corresponding rear-end director and a corresponding interface bus coupling the pair of matched directors. Yet, the

Examiner states independence of such directors would have been obvious to one skilled in the art simply in view of Walton and the general knowledge of the art. Applicant contends that the Examiner's assertion is one of hindsight and thus improper under 35 U.S.C. 103.

Regarding the Examiner's reliance on Applicant's admission that "Walton teaches a system that provides data integrity in case of a failure in disk controllers (e.g., rear-end directors) or CPU controllers (e.g., front-end directors)", Applicant believes the Examiner is incorrect. The Examiner explicitly states that "it would be reasonable for one of ordinary skill to suggest that the control elements are independent of each other or else the system would be inoperable if one of the controllers failed." The Examiner's conclusion that the front and rear end directors *must* be independent to achieve desired redundancy does not follow from the cited admission. Redundancy can be achieved by duplicating control units that are *not* independent front and back end control elements. Applicant admits such in the patent application (*See e.g.*, "Background of the Invention") when discussing known architectures having dual controllers (RDACs). An RDAC is a controller that has front and back end control elements integrated in a unified control element. A duplicate RDAC provides the redundancy desired by providing a complete, integral control element providing both front and rear end control functions and features.

Walton's structure is similar to the admitted prior art in that a matched pair comprising a front end director and a coupled rear end director constitutes a first controller. A second matched pair front and rear director comprises a second controller for redundancy if the first matched pair fails. The front and rear end directors of Walton are apparently so matched in pairs. Applicant's admission cited by the Examiner does not, therefore, require that the front and back end control elements must be independently scalable to permit desired redundancy. That is, in fact, one novel aspect of Applicant's claimed invention.

Should the Examiner mean, from the Examiner's comment, that "it would be reasonable for one of ordinary skill to *suggest* such independence of front and back end control elements, i.e., for one to *try* such a modification, Applicant respectfully submits that "obvious to try" is not a legitimate test of patentability. *In re Gieger*, 815 F.2d 686, 688, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987). For example, in *In re Gieger*, a Prima facie case of obviousness was not established when disclosures in prior art referenced in the patent application may have made it obvious to one skilled in the art to try various disclosed combinations. These disclosures, however, were

deemed insufficient to establish obviousness because of an absence of some suggestion in prior art supporting combination that resulted in the instant method. *Id.* at 688.

In the instant case, Applicant maintains there is no suggestion in prior art to make front-end control elements independent of back-end control elements – there is no reason presented in
5 Walton to try such independence since Walton addresses needed redundancy through apparently matched pairs of front and rear directors. The Examiner’s suggestion is merely one of hindsight and thus improper under 35 U.S.C. 103.

Applicant believes the Examiner is reading Applicant’s teachings into Walton’s teachings, since there is no teaching or reasonable suggestion in Walton to make independent
10 front-end and rear-end directors. Regardless, the Examiner offers no evidence as to why one so skilled in the art *when the invention was unknown and just before it was made* would have found it obvious to independently add front-end control elements and back-end control elements. Furthermore, Applicant cannot find reference in Walton stating the system would be inoperable if one of the controllers failed; such a statement is nothing more than a bald assertion or
15 speculation by the Examiner and indicative of hindsight.

Further regarding claim 1, Applicant respectfully disagrees with the Examiner’s statement that Walton’s Figure 7 reasonably suggests independence of front-end directors and rear-end directors since Walton is silent to any such modification. Walton, as stated by the Examiner, “does not specify which [directors] are front-end and which are back-end.” Since
20 Walton is silent as to independence of directors, Applicant contends that one so skilled in the art could only reasonably understand the teachings of Walton to employ connections of front and rear end directors as shown in his figure 2. Again, Applicant contends that Walton must have matching connections through the state data bus, because of the interface state data is transferred through the state data bus to corresponding front-end and rear-end directors. Applicant believes
25 the Examiner is again improperly reading Applicant’s teachings into Walton and again falling victim to hindsight.

Regardless, as noted further herein below, Applicant has amended claim 1 to recite the front-end control element being “substantially devoid of circuits and functions that control a plurality of I/O devices” and the back-end control element being “substantially devoid of circuits
30 and functions that interface directly with the attached host computer systems.” Such front-end and back-end control elements cannot read on Walton’s figure 7 because, inter alia, as pointed

out by the Examiner the reader cannot tell which director is front-end and which is rear-end (e.g., it is impossible to tell which director interfaces to a host computer system in figures 7 and 8 of Walton).

In a telephone interview with the Examiner and the Examiner's supervisor, Do H. Yoo, Examiner Yoo suggested that if the state data bus were removed from Walton, then Applicant's claims would read on Walton. Applicant understands that user data may be transferred between any front-end and rear-end director in Walton through the shared memory structures. However, Walton clearly teaches an interface state data bus connecting matched pairs of front-end and rear-end directors. While Walton does not specifically state why the matched pair connections to the state data bus exist, Examiner Yoo's suggestion to remove such connections would appear to only render Walton inoperable for its intended purpose because Walton intended that such a connection must exist in Figure 2. The connectivity of a front and rear director through a corresponding state bus is the critical feature of Walton to segregate certain state data transfers from other user data transfers through the shared memory buffers. Had Walton not intended that such a connection must exist, Walton surely would not have shown every director connected in matched pairs through a state data bus. In removing the connection, the Examiner is deconstructing Walton to read on Applicant's claims and rendering Walton likely inoperable for its intended purpose. It is well-established that modifying a reference and thereby rendering such a reference inoperable is improper for an obviousness type rejection. *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984). Furthermore, while Walton is likely inoperable with the removal of the interface state data bus, unwarranted modification of a reference is improper. *Carl Schenck, A.G. v. Nortron Corp.*, 713 F.2d 782, 786 (Fed. Cir. 1983).

Also during the telephone interview, Examiner Yoo correctly stated that Walton specifically teaches a cross-bar switch 123. In the hopes of advancing prosecution, Applicant has clarified claim 1 to recite that the interconnect element coupling the front and back end control elements is an SAN architecture that exchanges messages using address indicia associated with the control elements and embedded in the messages. The SAN architecture may be any of: PCI buses, local area network (LAN) connections (i.e., Ethernet or Gigabit Ethernet, etc.), Fibre Channel SAN switch devices and media, InfiniBand (www.infinibandta.org) and ServerNet (developed by Tandem and presently sold by Compaq). Applicant's amended claim 1 patently distinguishes from a cross bar switch in a novel and non-obvious way, because, inter

alia, cross-bar switches do not use such address indicia to exchange messages. Applicant's claimed interconnect element is neither taught nor reasonably suggested by Walton or Brown.

Applicant has amended claim 1 to better clarify the claimed storage system by including recitations that the "front-end control elements differ in number from the back-end control elements," and recitations that the back-end control element is "communicatively coupled to a plurality of I/O devices." Additionally, claim 1 is amended to recite the front-end control elements "using RAID storage management." Applicant has also amended claim 1 to include additional recitations in that the interconnect element is an SAN architecture that utilizes an SAN fabric with addressed messages exchanged between the front and back-end control elements. Still, other amendments to claim 1 recite that the front-end control element being "substantially devoid of circuits and functions that control a plurality of I/O devices." In like manner, the back-end control element is "substantially devoid of circuits and functions that interface directly with the attached host computer systems."

In view of the above discussion, Applicant maintains claim 1 is novel and non-obvious in view of the cited prior art, either alone or in combination. Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 1.

Regarding claims 2-10, 12 and 13, these claims depend from claim 1 and include other novel aspects of the Applicant's claimed invention. Accordingly, claims 2-10, 12 and 13 are novel and non-obvious for at least the same reasons as claim 1. Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 2-10, 12 and 13.

Claims 14-18

Regarding claim 14, Applicant has amended claim 14 to recite language that is similar to that of claim 1. Claim 14 recites another embodiment of the invention that varies in scope from claim 1. The arguments that applied to claim 1 apply to claim 14, mutatis mutandis. Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 14.

Claims 15-18 depend from claim 14 and include other novel aspects. Claims 15-18 are therefore allowable for at least the same reasons of claim 14. Applicant maintains that the cited prior art neither teaches nor reasonably suggests that which Applicant claims. Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 15-18.

Claims 19-23

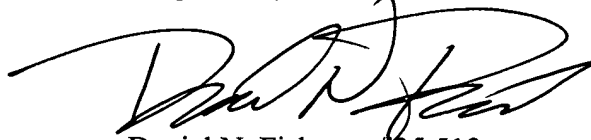
Regarding claim 19, Applicant has amended claim 19 to recite language that is similar to that of claim 1. Claim 19 claims another embodiment of the invention that varies in scope from claim 1. The arguments that applied to claim 1 apply to claim 19, mutatis mutandis. Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 19.

Claims 20-23 depend from claim 19 and include other novel aspects. Claims 20-23 are therefore allowable for at least the same reasons of claim 19. Applicant maintains that the cited prior art neither teaches nor reasonably suggests that which Applicant claims. Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 20-23.

CONCLUSION

Applicant has thoroughly discussed the Examiner's rejections of claims 1-10 and 12-23 in the Office Action mailed on 11 March 2003. Applicant has amended claims 1-3, 5, 6, 14, and 19. Claims 1-10 and 12-23 remain pending in this application. Claim 11 was cancelled in a prior Non Final Office Action Response. Applicant maintains the claims distinguish from the teachings of all prior art of record, alone or in any combination. Applicant respectfully requests reconsideration and withdrawal of all outstanding rejections. If any additional fees are believed due, the Examiner is authorized to charge the Applicant's deposit account number. Should any issues remain, the Examiner is encouraged to telephone the undersigned attorney so that this application may be better framed for appeal.

Respectfully submitted,



Daniel N. Fishman #35,512
Lathrop & Gage, L.C.
4845 Pearl East Circle, Suite 300
Boulder, CO 80301
(720) 931-3025
(720) 931-3001 (fax)